



User Manual for 16V/58F Modules

Models:

- Industry Standard footprint
 - iMOD016V058P1M-00A

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Never touch the power terminals as any residual voltage can cause fatal electrical shocks, Always check with a calibrated meter that the module is discharged prior to handling the module, please see the step by step instructions in this manual for the discharge procedure.

Warranty Limitation

Ioxus modules are unserviceable property of the customer and if opened or otherwise modified, are no longer covered by any warranty written or implied

Introduction

Ioxus modules represented in this document are designed for a wide variety of applications from stationary back up power to transportation usage. Each module is built with heavy copper trace circuit cards and internal balancing circuitry. The balancing circuitry is passive, ideal for high reliability float voltage applications. The entire structure is rugged and well built to meet the long life requirements for the applications this product fits best in, and also meets the dust resistance requirements of IEC 60529 – IP54. The specifications and recommended configurations suggested in this manual are subject to change and should be verified by checking the most recent version of this document and the product datasheets on www.IOXUS.com.

Module Part Numbering and it's Meaning

i	MOD	x	x	x	V	y	y	y	B	G	T	-	z	z	R
															REV
															Numeric for Proto
															Alpha for Production
															Option Codes
															Numeric for standard
															Alpha for customer specials
															separator (used for readability)
															Cell Terminal Type
															Cell Type
															P for passive balancing w/o clamping
															A for semi-Active 2 stage balancing w/clamping
															B for balancing w/ single stage clamping
															X for no balancing
															others possible
															Capacitance value rounded to the nearest Farad (three digits)
															V for "voltage" (for multiples of 6 cells, round down to closest multiple of 16)
															module voltage rating in Volts (three digits)
															M for "module"
															i for IOXUS

Handling

Unpacking

Please inspect the shipping carton for signs of damage prior to unpacking the carton. Report any damage to the carton, or the contents, to the carrier immediately. Retain all shipping materials until the module is fully inspected and determined to be operational.

The module should be lifted by the module body. The terminals should not be used for hoisting. Any terminal shorting wire should remain in place until ready to connect.

If any parts are determined to be missing or defective an RMA number must be issued prior to returning the unit for repair or replacement. Please contact your salesperson or distributor to request an RMA number.

Handling

Ultracapacitor modules are designed for years of maintenance free operation if handled, installed and used properly. These handling precautions should be observed.

- The modules should not be stacked unless still in original packaging
- The only tools to be used on the module should be properly sized wrenches for the terminal and mounting bolts (hammers, chisels, files or power tools in general should not be used)
- Do not drop modules, invisible internal damage may occur

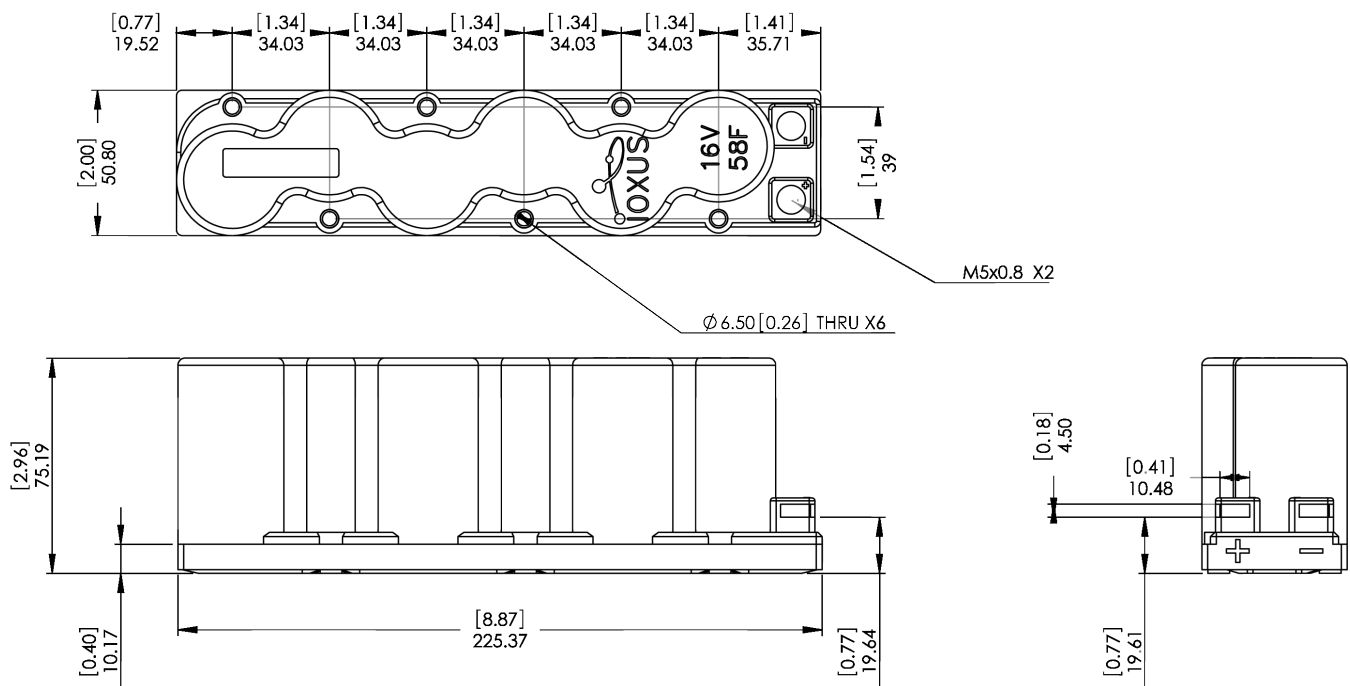
Installation

Orientation and Application

16V modules can be mounted in any orientation and are qualified for shock and vibration as is detailed on the applicable datasheet. Please review the datasheet and test specifications to determine the appropriateness of the module for your application.

The modules should not be mounted anywhere where the frame member mounted to applies any stress, torque, or twisting to the module housing. All mounting holes are located on the end plates, and should be mounted to points that are in plane with each other (or parallel to each other for Rack mount applications). Shims and spacers should be used if any of the mounting points are more than $\pm 1\text{mm}$ out of plane. 5 or 6mm hardware of a grade appropriate for the application should be used for 16V58F modules. Mounting multiple modules side by side requires an offset of 52mm.

In addition, it is best to avoid mounting on or near significant heat sources such as engine exhausts or solar heated panels



Environment

For best results modules should not be exposed directly to the environment, this module is not rated for exposure to moisture and thus should be protected in a secondary enclosure for non-air-

conditioned environments. In systems with voltages greater than 60V, protection of the terminals to avoid shock and corrosion should be instituted.

Modules that are expected to see significant cycling should be mounted in free air or in a forced ventilation housing. Care should be taken to protect modules in potentially corrosive environments and direct water splash, spray or condensation should be avoided.

Careful design consideration should be given to the application to prevent the overheating of the modules. Please refer to the operational temperature range on the data sheet and be sure to allow for internal heating of the modules. If you require help with the design considerations and sizing



please contact your representative for assistance.

Electrical

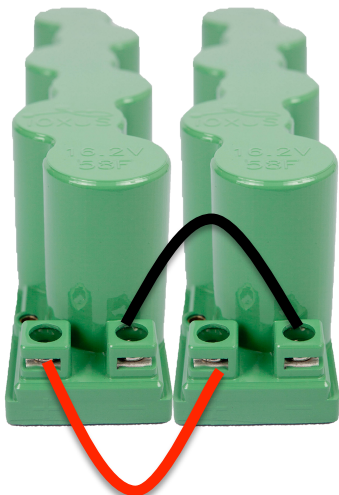
Modules can be mounted in series and/or parallel with each other. Care should be taken to insure that similar capacitance and ESR modules are used for series chains and that if different type or

age modules are used in parallel configurations the differences in ESR are accounted for in your design.

Appropriate size bus bars or cables and terminals should be used for the application. Please note, that to minimize system losses the capacitors do not have fusing or internal circuit breakers, careful consideration in the system design should be taken to prevent over current. With the low ESR of the capacitors they can deliver very large amounts of current.

Thread locking should be done with star washers or an appropriate chemical thread locker applied to the threaded portions only; in no case should flat washers be used with lock washers.

Care should be taken in cable routing to not impose undue forces (torques or tensions) on the module terminals. Only appropriately sized ring terminals or bus bars for the expected currents should be used.



Parallel Connections



Series Connections

Balancing

The balancing for this module is a simple, highly reliable passive system comprised of $120\Omega \pm 1\%$ resistors in parallel with each cell. In general, your charging system must be able to provide enough current to overcome the loss of the resistors plus the leakage current of the capacitors, which approaches zero as time as voltage approaches infinity (becomes very small over the first few days of operation at float voltage). A typical series system will have a resistive loss of V_{cell}/R , where V_{cell} is the voltage of the individual capacitors and R is the resistance of the resistor. Subsequently for any single parallel cell chain built with these modules the current loss as time at voltage increases will approach $V_{\text{cell}}/120\Omega$ or 23mA (at 2.7V/cell).

Safety



Never touch the power terminals as any residual voltage can cause fatal electrical shocks, Always check with a calibrated meter that the module is discharged prior to handling the module, please see the step by step instructions in this manual for the discharge procedure.

- Prior to installation or removal the module and or system of modules must be discharged fully and shorting wires installed (procedure below)
- Provide sufficient electrical isolation for operation above 50VDC (relative to ground)
- Protect surrounding electrical and conductive components from incidental contact
- Do not operate above specified voltage or temperature range
- Do not touch terminals while charged, serious burns, shock or material fusing may occur

Discharging



A fully discharged module may “bounce back” if it is stored without a shorting wire connected to the + and – terminals. This bounce back can be as much as 2V for the 16V module, and is enough to cause dangerous electrical shocks and other undesirable consequences.

Prior to any maintenance or replacement each module should be individually discharged and shorted with a resistor or wire. ***Even a fully discharged module can rebound naturally to an unsafe condition.*** Be sure to discharge with an appropriately sized resistor or resistor bank (not provided) and either keep that resistor attached or replace it with a shorting wire or bus bar when the module is depleted. Be sure to check the voltage with a calibrated meter prior to attaching the shorting device. The voltage should be $0 \pm 0.25V$.

1. Using a voltmeter, measure the voltage between the 2 terminals.
2. If the voltage is above 2V, a resistor pack (not supplied with the module) will need to be connected between the terminals. Proper care needs to be taken in the design and construction of such a dissipative pack. e.g. At 48V (3 modules in series), for a 4 Ohm pack, the module will be initially discharged with a current of 15A and will take about 5 minutes to fully discharge. However, in this case, the heat/power dissipated in the resistor pack will be $\sim 1kW$. The resistor pack will need to be sized and provided with suitable cooling to handle this power dissipation. Additionally, proper enclosure or other packaging is necessary to ensure safety. In all cases, proper design of the dissipative resistor pack is necessary.
3. If the voltage is under 2V, connect a shorting wire to the + and – connectors.
4. The module is now safe for handling. Leave the shorting wire connected for servicing at all times.

Accessories

Module accessories such as mating connectors and terminal hardware are available for order. Custom cables, and bus bars are available on request but may require an NRE charge and will require all relevant mounting considerations in order to design your product. Please contact your Ioxus representative with questions or requests.

Operation

All modules should only be operated within their prescribed voltage, constant current and temperature, operating window. These should be monitored to ensure the safe operation and long life of your module.

NOTE: Operation of module above 65C will void the warranty

Maintenance

The modules should be kept free of dust and debris and cleaned at a regular interval. In inside locations, that should be no more than annually however this may vary with your particular circumstances. Outside location will be as needed. Once the modules are discharged, proceed with cleaning with a cloth and a simple water/soap solution. Avoid the use of hoses or pressurized



sprays. Once the assembly is clean check for properly torqued fasteners and note any damage to any of the housings or signs of internal damage and replace as necessary.

In high vibration applications fasteners used for mounting as well as electrical connections should be checked for torque every 6 months.

Reconditioning

This module does not require reconditioning because of the passive balancing.

Storage

The module can be stored in the original package in a dry place. Observe the maximum storage temperature as stated in the specifications. Discharge used module prior to stock or shipment (the module will naturally self discharge to 0V over a few days). A shorting wire is not required for storage once the module reaches 0V because of the passive balancing but may be required for shipment.

Disposal

Please recycle according to local codes and regulations for flammable materials.